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EXAMINER	
ALBERTALLI, BRIAN LOUIS	
ART UNIT	**PAPER NUMBER**
2655	

DATE MAILED: 02/15/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/943,091	Applicant(s) HAIN, HORST-UDO	
	Examiner Brian L Albertalli	Art Unit 2655	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4,6 and 8-13* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4, 6, and 8-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The amendments to the claims have been entered. Claims 1-3, 6, 8-9, and 12-13 are currently amended and claims 5 and 7 have been cancelled.

Response to Arguments

2. Applicant's arguments filed October 27, 2004 have been fully considered but they are not persuasive.

Claims 1 and 12 have been amended to include the limitation "the assignment of graphemes to phonemes within a word is corrected with aid of position-dependent frequencies". The applicant argues that Besling teaches assigning the graphemes to phonemes using dynamic time matching where relative frequencies are used for the allocations without any correction by position dependent frequencies (page 7, last paragraph through page 8, line 2 of the arguments). However, this relied upon section of Besling is only directed to the initial assignment of graphemes to phonemes.

Besling continues in the next section (Section 3) to describe a method for correcting the assignment of graphemes to phonemes with the aid of position-dependent frequencies. Specifically, beginning with the initial assignments (as described in section 2), the grapheme-phoneme sequence is stretched to correct the assignment of graphemes to phonemes (page 370, 2nd paragraph, lines 1-3). The correction is computed through an estimation of what Besling calls the "matching model", wherein the probability (frequency) of a grapheme g_i being assigned to a

phoneme is dependent on the *previous* graphemes g_{i-2} and g_{i-1} as well as the *previous* phonemes p_{i-2}, p_{i-1}, and the current phoneme p_i (see page 370, 5th paragraph and the final equation on page 370). Since this probability (frequency) calculation depends on *previous* graphemes and phonemes, it is, by definition, *position dependent*. The applicant is further directed to page 368, section 2, 2nd paragraph, wherein Besling discloses the method takes into account dependencies between letters to determine the assignment of graphemes to phonemes.

In regard to claim 4 (see page 8, 3rd paragraph of the arguments), as discussed above, Besling discloses "allocation of the graphemes to phonemes within a word corrected using position dependent relative frequencies". Additionally, Besling discloses "after the execution of the assignment of graphemes to phonemes for each word of the lexicon, these assignments are used to determine the relative frequency..." (see rejection of claim 4 from previous action, and page 370, 3rd paragraph of Besling wherein the background lexicon is used as a basis to determine the grapheme and phoneme stretching probability).

In regard to claims 2 and 13 the argument that the combination of Besling and Sakoe et al. does not teach or suggest "where the assignment of graphemes to phonemes within a word is corrected with the aid of position-dependent relative frequencies" (page 9, 4th paragraph) is not persuasive because, as discussed above, Besling discloses that limitation. The combination of Besling and Sakoe et al., as

applied to claims 2 and 13, therefore teaches using the matrix elements along the path to define the assignments of graphemes to phonemes of the word where the assignment of graphemes to phonemes within a word is corrected with the aid of position-dependent relative frequencies.

3. Therefore, the prior art rejections made in the previous Office Action stand.

Claim Rejections - 35 USC § 112

4. The amendment to claim 9 overcomes the rejection under 35 U.S.C. 112 made in the previous Office Action. The rejection to claim 9 under 35 U.S.C. 112 is withdrawn.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims 1, 4, 8, 9, and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Besling (*A Statistical Approach to Multilingual Phonetic Transcription*).

In regard to claim 1, Besling discloses a method of assignment of phonemes to a lexicon of words that uses a dynamic time warping algorithm (dynamic programming) to phonetically transcribe words by assigning phoneme sequences to grapheme sequences of the words (section 2), where the assignment of graphemes to phonemes

within a word is corrected with aid of position-dependent relative frequencies (see page 369, lines 4-6, page 370, 5^{th} paragraph and the final equation on page 370).

In regard to claim 4, Besling discloses that after the execution of the assignment of graphemes to phonemes for each word of the lexicon, the assignments are used to determine the position-dependent (probability of a grapheme g at a position i, g_i) relative frequency with which the following combinations occur:

a) a phoneme produced by two or more graphemes (phoneme stretching)

b) two or more phonemes produced by a grapheme (grapheme stretching)

c) two or more graphemes assigned to a phoneme (phoneme stretching), and

d) a grapheme assigned to two or more phonemes (grapheme stretching).

See page 369, lines 14-18, Fig. 2, and section 3.

In regard to claim 8, as depending on claim 1, Besling discloses after assigning graphemes to phonemes for selected words in the sequence of the specification, the corrected assignments are used to recalculate the relative frequency with which a phoneme is produced by two or more graphemes, or two or more phonemes are produced by a grapheme. Hypotheses for a phonetic transcription are evaluated using a matching model (that generates corrected assignments) that calculates the position-dependent relative frequency with which a phoneme is produced by two or more graphemes or two or more phonemes that are produced by a grapheme. All new

hypotheses are recalculated for each possible phoneme string (Fig. 1 and page 372, lines 3-15).

The recalculated position dependent relative frequencies are used to again assign graphemes to phonemes for selected words in the sequence of the specification (hypotheses that have been generated by the position dependent relative frequencies are recursively investigated, page 372, lines 13-15).

In regard to claim 9, as depending on claims 1 and 8, Besling discloses in determining the relative frequencies, only those assignments are taken into account which the matrix entry for the last phoneme and the last grapheme exceeds a prescribed threshold value (page 372, lines 10-11).

In regard to claim 12, Besling discloses a computer system (automatic system) that executes a program that uses a dynamic time warping algorithm (dynamic programming) to phonetically transcribe words by assigning phoneme sequences to grapheme sequences of the words (section 2).

A computer system inherently includes a storage device for storing a computer program on a storage medium and a processing unit for loading the computer program from the storage device and executing the computer program.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 2, 3, 6, 8-11, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Besling in view of Sakoe et al. (*Dynamic Programming Algorithm Optimization for Spoken Word Recognition*).

In regard to claim 2 and 13, Besling discloses a method of assigning phonemes to the graphemes producing them. The method is implemented in a program for controlling a computer (automatic system), which, inherently, must be stored on a computer readable medium. The method includes the following steps:

Determining the relative frequency with which phonemes and graphemes are assigned to one another for each assignment of phoneme and graphemes (probability distribution for production of a phoneme by a grapheme, page 369, lines 3-9).

Creating a two dimensional matrix, one index of which is given by the grapheme of the word and the second index of which is given by the phoneme of the word (Fig. 1).

The relative frequencies belonging to the respective phoneme-grapheme pairs are used as entries in the matrix (distance penalties are assigned according to the relative frequencies for each grapheme-phoneme pair, page 369, lines 3-9).

Additionally, Besling discloses that the two dimensional matrix is used to align graphemes to phonemes by dynamic time warping (dynamic programming, page 368, line 25 - page 369, line 2).

Furthermore, Besling discloses that the matrix elements along the path define the assignment of graphemes to phonemes of the word.

Still further, Besling discloses the assignment of graphemes to phonemes within a word is corrected with aid of position-dependent relative frequencies (see page 369, lines 4-6, page 370, 5^{th} paragraph and the final equation on page 370).

Besling is silent as to the details of the dynamic time warping (dynamic programming) algorithm used to align the phonemes to the graphemes.

Sakoe et al. discloses a dynamic time warping (dynamic programming) method. The method includes the following steps:

A two dimensional matrix is given (in which two patterns A and B are developed along the *i* and *j* axis, respectively; herein the *i* axis will correspond with graphemes and the j axis will correspond with phonemes), in which the distance (d(*i*,j), corresponding to the relative frequencies, as mentioned above) between the two patterns is used as entries of the matrix (Fig. 1).

Each matrix entry is logically combined (added) with the extreme value (minimum) of either:

a) the entry for the same phoneme and the preceding grapheme in the word (Table 1, P=0, Symmetric case, g(i,j-1) + d(i,j)).

b) the entry for the preceding phoneme and the same grapheme in the word (g(i-1,j) + d(i,j)).

c) and the entry for the preceding phoneme and the preceding grapheme in the word (g(i-1,j-1) + 2d(i,j)).

These entries are logically combined using the first phoneme of the word as the starting point in the mathematical operation and using the modified entries yielded from the mathematical operation, to determine which of the three preceding matrix entries was extreme to determine a step direction for that matrix entry (Fig. 4, sections III-A and III-B).

The step direction determined for the matrix entry is defined, starting from the matrix entry for the last phoneme and last grapheme, and proceeding along a path through the matrix up to the matrix entry for the first phoneme and the first grapheme (Fig. 1).

It would have been obvious to one of ordinary skill in the art at the time of invention to modify the method of aligning graphemes to phonemes by using a dynamic time warping (dynamic programming) method, as disclosed by Besling, by using the specific algorithm of dynamic time warping (dynamic programming), as disclosed by Sakoe et al., with patterns A and B being graphemes and phonemes, respectively, because the algorithm is optimal and superior to several other dynamic time warping (dynamic programming) algorithms, as taught by Sakoe et al. (section VI).

In regard to claim 3, Besling does not disclose the relative frequencies in the first step are determined by selecting words from the lexicon in the case of which the number of the graphemes and the number of the phonemes coincide, for the selected words, the graphemes and phonemes are assigned to one another in the sequence of the specification of their graphemes and phonemes in the lexicon.

The examiner takes official notice that it is well known and recognized in the art that there is no need to implement dynamic time warping when two patterns are already aligned (such as when the number of graphemes and phonemes is the same).

It would have been obvious to one of ordinary skill in the art at the time of invention to modify Besling so that if the number of graphemes and phonemes for the selected words coincided, the graphemes and phonemes would be assigned to each other in the sequence of specification in the lexicon, thereby reducing processing time because the dynamic time warping method would be implemented fewer times.

In regard to claim 6, Besling discloses that after the execution of the assignment of graphemes to phonemes for each word of the lexicon, the assignments are used to determine the position-dependent (probability of a grapheme g at a position i, g_i) relative frequency with which the following combinations occur:

a) a phoneme produced by two or more graphemes (phoneme stretching)

b) two or more phonemes produced by a grapheme (grapheme stretching)

c) two or more graphemes assigned to a phoneme (phoneme stretching), and

d) a grapheme assigned to two or more phonemes (grapheme stretching). See page 369, lines 14-18, Fig. 2, and section 3.

In regard to claim 8, as depending from claim 2, Besling discloses after assigning graphemes to phonemes for selected words in the sequence of the specification, the corrected assignments are used to recalculate the relative frequency with which a phoneme is produced by two or more graphemes, or two or more phonemes are produced by a grapheme. Hypotheses for a phonetic transcription are evaluated using a matching model (that generates corrected assignments) that calculates the position-dependent relative frequency with which a phoneme is produced by two or more graphemes or two or more phonemes that are produced by a grapheme. All new hypotheses are recalculated for each possible phoneme string (Fig. 1 and page 372, lines 3-15).

The recalculated position dependent relative frequencies are used to again assign graphemes to phonemes for selected words in the sequence of the specification (hypotheses that have been generated by the position dependent relative frequencies are recursively investigated, page 372, lines 13-15).

In regard to claim 9, as depending on claims 2 and 8, Besling discloses in determining the relative frequencies, only those assignments are taken into account which the matrix entry for the last phoneme and the last grapheme exceeds a prescribed threshold value (page 372, lines 10-11).

In regard to claim 10, Besling discloses that the matrix entry for the first phoneme and first grapheme of each word (word start) and the matrix entry for the last phoneme and last grapheme of a word (word end) are marked to capture the special behavior at those points (page 371, second paragraph, lines 3-4).

Besling does not disclose that both those matrix entries are set to 1. Furthermore, Besling does not disclose that the matrix entry for the first phoneme and the last grapheme of each word is set to 0, or that the matrix entry for the last phoneme and the first grapheme of each word is set to 0.

Sakoe et al. discloses that a slope constraint (P, equation 9) is used to prevent the unrealistic alignment of two patterns (such as the alignment of a first phoneme with a last grapheme, or a last phoneme with a first grapheme, section II-B, Slope constraint condition 5, pages 44-45).

It would have been obvious to one of ordinary skill in the art at the time of invention to modify Besling so that the matrix entry first phoneme and first grapheme of each word (word start) and the matrix entry for the last phoneme and last grapheme of a word (word end) were set to 1 (indicating a 100% probability that the first phoneme will align with a first grapheme and a last phoneme will align with a last grapheme), to ensure the proper alignment of the graphemes to the phonemes. It also would have been obvious to one of ordinary skill in the art at the time of invention to further modify Besling so that the matrix entry for the first phoneme and the last grapheme of each word was set to 0, or that the matrix entry for the last phoneme and the first grapheme

of each word was set to 0, thereby implementing a slope constraint, as taught by Sakoe et al., in order to prevent the unrealistic alignment of two patterns, as taught by Sakoe et al.

In regard to claim 11, Besling discloses most transcription errors are caused by one or two phoneme errors in a given word (Table III and page 375, lines 14-19).

Besling does not disclose that if in the determination of the maximum value of the three preceding matrix entries in the matrix entry for the preceding phoneme and the preceding grapheme in the word and one of the other two entries are of equal magnitude, the matrix entry for the preceding phoneme and the preceding grapheme in the word is regarded as maximum.

Sakoe et al. discloses the determination of maximum value of the three preceding matrix entries (Table III, Velichko and Zagoruyko algorithm).

Sakoe et al. does not explicitly disclose that if the entry of the preceding phoneme and preceding grapheme in the word and one of the other two entries are of equal magnitude, the matrix entry for the preceding phoneme and grapheme is regarded as maximum (no definition is given for the case when two of the entries are equal).

It would have been obvious to one of ordinary skill in the art at the time of invention to modify Besling to determine the maximum value of the three preceding matrix entries, as disclosed by Sakoe et al., so that if the entry of the preceding phoneme and preceding grapheme in the word and one of the two other entries were of

equal magnitude, the matrix entry for the preceding phoneme and grapheme was regarded as maximum, in order to reduce the chances of a phoneme being assigned to an incorrect grapheme.

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L Albertalli whose telephone number is (703) 305-1817 until March 24, 2005. After March 24, 2005 the examiner can be reached at (571) 272-7616. The examiner can normally be reached on Mon - Fri, 8:00 AM - 5:30 PM, every second Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Talivaldis Smits can be reached on (703) 305-3011 until March 24, 2005.

After March 24, 2005 Talivaldis Smits can be reached at (571) 272-7628. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BLA 2/9/05

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PRIMARY EXAMINER